

# Maryland Smart Energy Communities

## Renewable Energy Assessment Planning and Financing

September 5, 2013 Webinar

Hosted by Doug Hinrichs, MEA and Sean Williamson, UMD-EFC

Please enable your microphone or use the call-in number provided to participate.

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# Agenda

- Overview of Renewable Energy Assessment Plans (REAPs)
- Sample scenarios and constructing some **simple** analysis
- Summary of the REAP process and important notes
- Strategies for solar success
  - Siting
  - Sizing
  - Net metering
  - Financing
  - Permitting

# Baseline: Precursor to a REAP

- **Establish renewable baseline**
  - Measured as kilowatt-hours or megawatt-hours of **consumed** electricity/year ***NOT*** *normalized as kWh/gross square foot (Efficiency Policy)*
    - E.g. Baseline for renewable goal = 8,280 MWh

      ***NOT*** *.012 MWH/gross square foot*
  - Consumed = purchased electricity + generated electricity
- **Note about thermal energy**
  - Thermal energy – energy created for heating, not electricity
    - E.g., Geothermal and solar thermal
  - Does not count towards baseline, but does count towards target…

# REAP – Five Components*

- 1 – Letters of approval for REAP from Council
- 2 – Executive Summary of baseline, goal, and plans
- 3 – Narrative describing energy baseline
- 4 – Narrative describing goal, existing RE and plans to expand over coming decade
- 5 – References

*In most cases, this is already complete.*

*Area of focus.*

* These five components are guidelines for how to design and package the REAP. We are very flexible on this point…

# Part 4 – Constructing the REAP

- Step 1: How much RE needs to be generated by 2022?
  - = (.20) x baseline electricity consumption (e.g., 8.28 million kWh)

    *or 1.66 million kWh by 2022*
- Step 2: How much RE is currently being generated?
  - Method 1: Use RE generation data, if available
  - Method 2: Use RE capacity data, definitely available
- Step 3: What is the current RE generation shortfall?
  - = required generation – existing generation

    *or the amount of additional generation that needs to occur*

**NOTE:**

Capacity refers to power and is expressed as kW

Generation refers to energy and is expressed as kWh

# Sample analysis

| | |
|---|---|
| Baseline (kWh per year) | 423,982 |
| 20 % (kWh per year) | 84,796 |
| Existing solar PV capacity (kW) | 3.5 |
| Estimated energy generation (kWh per year, or kW x 1,227 hrs/year)* | 4,294 |
| Shortfall in annual generation (kWh) | ~80,500 |
| **Option 1** for new RE capacity: All solar PV (kW installed) | 65.6 |
| **Option 2** for new RE capacity: Solar PV + geothermal heating and cooling system | 14 kW solar +<br>10 ton GH&C |
| *Multiple options depending on what suits your community* | |

* MEA has a renewable energy analysis sheet available with agreed upon capacity factors.

# Constructing the REAP

- Step 4: Matching RE technology with your community:
  - What type of RE is your community interested in?
  - How much space is available and where?
    - Consider "responsible siting" on parking lots, Brownfields, landfills, and wastewater treatment plants.
  - What is the most cost effective technology given this context?
- Step 5: Assessing locations, project specifications, and economics:
  - Examine what a given technology and a specific location would yield in terms of project size (capacity) and cost.
  - Compare and aggregate projects.

# Finalizing the REAP

- Step 6: Demonstrate planned projects will achieve target

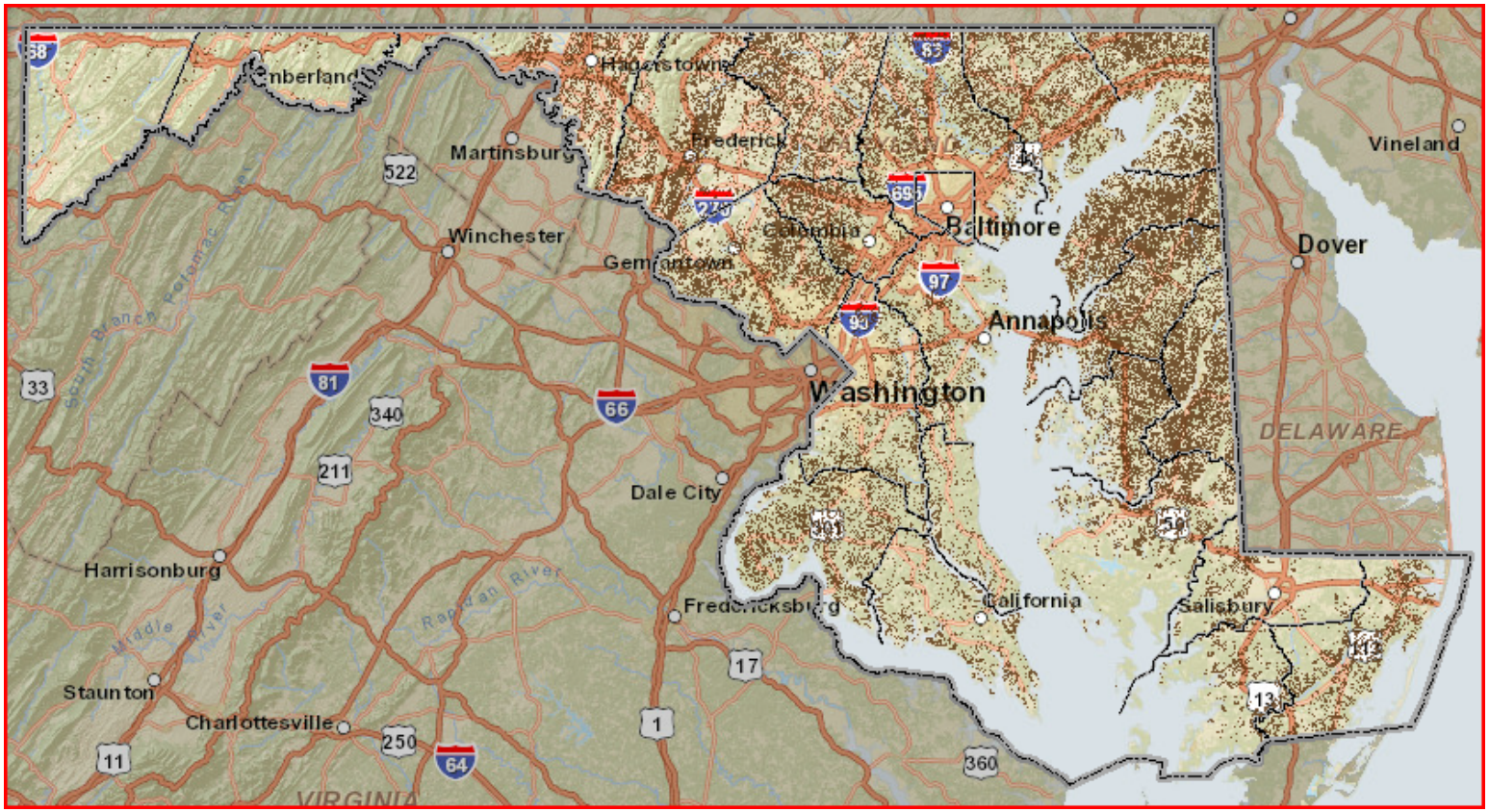
| Project Name | Energy Technology | Annual Gen. | Year of Install. | Cost | Financing |
|---|---|---|---|---|---|
| Rec Center GH&C | 10 ton geothermal | ~65,000 kWh | 2014 | $40,000 | MSEC Grant and General Fund |
| Town Hall Solar | 14 kW solar | ~17,000 kWh | 2017 | $61,000 | PPA |
| Police Dept. Solar | 3.5 kW solar | ~4,000 kWh | 2012 | Existing | Existing |

**All projects total ~86,000 kWh of annual generation, which is greater than 20% of baseline = ~85,000 kWh**

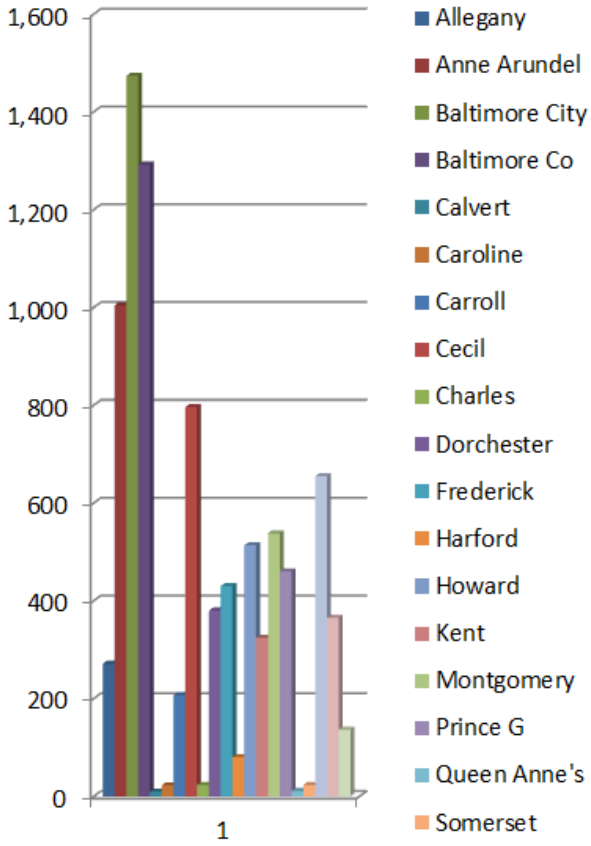
# Summary and Important Notes

- We are very flexible about how communities package and design their planning documents. This presentation and the guidance documents serve mostly as a template.
- We are looking for a few key components though:
  - Some thoughtful, quantitative analysis about how much RE is needed
  - Consideration of locations where RE might go and system specs
  - Implementation pieces such as financing ideas and staff responsibilities
  - Approval from an executive strengthens the plan
- We recognize communities will not have all project details at this point and commitment to specific projects is difficult. TBD is acceptable…
  - As a guiding principle, the more effort and collaboration put into the planning, the better the chances of meeting the goals. We want communities to meet the goals.
- Treat the action plan as a living document that will be updated when more information is available in future years while making a good-faith effort now.

# Strategies for Solar Success: Siting



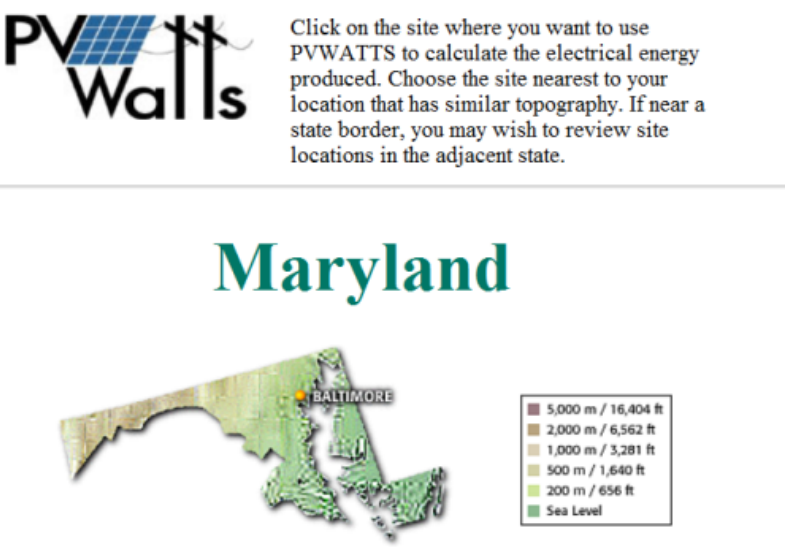
# Strategies for Solar Success: Siting





# Strategies for Solar Success: Sizing


http://maps.nrel.gov/imby




http://rredc.nrel.gov/solar/calculators/PVWATTS/version1/US/Maryland/Baltimore.html

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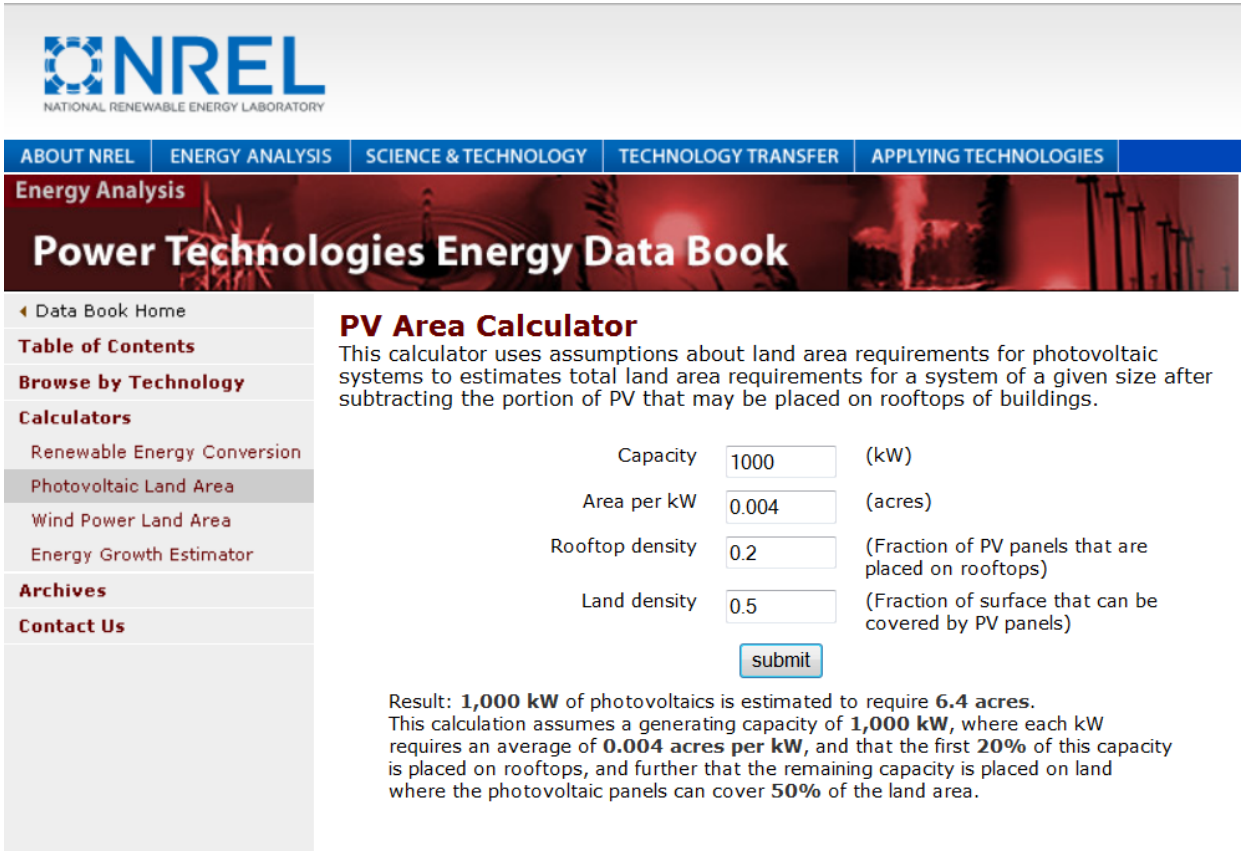
# Strategies for Success: Sizing



# Strategies for Success: Net metering

*Your bi-directional meter will continue to be read once each month. The meter measures the energy generated by your solar system and the energy consumed by you over a month's time, and will display the net difference. Over a year, your energy usage totals may look something like the example below.*

**Relevant Period:** August to July

| Month 1 (Aug) | Month 2 (Sept) | Month 3 (Oct) | Month 4 (Nov) | Month 5 (Dec) | Month 6 (Jan) | Month 7 (Feb) | Month 8 (Mar) | Month 9 (Apr) | Month 10 (May) | Month 11 (June) | Month 12 (July) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| *Generated* 550 kWh | *Generated* 520 kWh | *Generated* 420 kWh | *Generated* 200 kWh | *Generated* 155 kWh | *Generated* 190 kWh | *Generated* 185 kWh | *Generated* 215 kWh | *Generated* 395 kWh | *Generated* 410 kWh | *Generated* 465 kWh | *Generated* 550 kWh |
| *Consumed* 500 kWh | *Consumed* 510 kWh | *Consumed* 500 kWh | *Consumed* 400 kWh | *Consumed* 475 kWh | *Consumed* 415 kWh | *Consumed* 395 kWh | *Consumed* 405 kWh | *Consumed* 420 kWh | *Consumed* 405 kWh | *Consumed* 410 kWh | *Consumed* 525 kWh |
| Energy Charges = **–50 kWh** (energy usage credit) | Energy Charges = **–10 kWh** (energy usage credit) | Energy Charges = **80 kWh** (energy usage charge) | Energy Charges = **200 kWh** (energy usage charge) | Energy Charges = **320 kWh** (energy usage charge) | Energy Charges = **225 kWh** (energy usage charge) | Energy Charges = **210 kWh** (energy usage charge) | Energy Charges = **190 kWh** (energy usage charge) | Energy Charges = **25 kWh** (energy usage charge) | Energy Charges = **–5 kWh** (energy usage credit) | Energy Charges = **–55 kWh** (energy usage credit) | Energy Charges = **–25 kWh** (energy usage credit) |

This customer's **annual energy bill** will be tallied as follows= (50) + (10) + 80 + 200 + 320 + 225 + 210 + 190 + 25 + (5 ) + (55) + (25) x Domestic Energy Rate per kWh

- 2 MW cap for PV system
- PV energy offsets grid power, at full retail electricity rates
- In some months, a PV generator may produce more electricity than building can use, creating "net excess generation" (NEG)
- Compensation for NEG remaining in a customer's account after a 12-month period ending in April is paid to the customer at the commodity energy supply rate

# Strategies for Success: Financing

- Costs
  - $2,200-2,600/kW (total installed cost)
  - 250 kW x $2,400/kW (avg.) = $600,000
  - Land/rooftop lease?
- Revenues
  - Sale of solar energy
    - If net metered, full retail offset of, e.g., 8-12 cents/kWh
  - MD SRECs
    - Currently, 34% of SACP

# Strategies for Success: Financing

- Power Purchase Agreements (PPAs)
  - Allows local governments (which don't pay taxes) to partner with solar developers to take advantage of Federal tax credits, reduce risk, etc.
  - No upfront capital cost to local government
  - No system performance risk or operating risk for local government
  - Developer can take advantage of Federal ITC (30%) and MACRS (20%)
  - Predictable energy pricing for 20+ years

# Strategies for Success: Financing

***NMWDA***

***George Carver Washington***

***Talbot County Community Center***

***Coppin State University***


***Back River WWTP***

***Frederick County Oakdale High***

# Strategies for Success: Financing

**Solar Project Assumptions**

| | | |
|---|---|---|
| Total System Size: | 100 | kW DC |
| Installation Type: | Ground Mount | *See costs at right* |
| Total Project Cost: | $3.00 | $/Watt |
| Estimated System Production: | 132,000 | kWh/Year |
| Federal Tax Rate: | 35.0% | |
| State Tax Rate: | 5.5% | |
| Land Cost: | $0 | |
| Land Lease Cost: | $0 | $ / Year |
| O&M, Asset Management, Insurance Cost | $24 | $ / kW DC / Year |
| O&M, Asset Managment, Insurance Escalator | 3.0% | |
| Inverter Reserve / Soft Cost Contingency | $12 | $ / kW DC / Year |
| System Degredation Factor | 0.5% | |
| System Installation Year | 2013 | |
| Electricity Offset Rate / PPA Rate | $0.095 | $/kWh |
| Electricity Escalator | 1.0% | |
| SREC % ACP | 30.0% | |
| Investment Tax Credit: | 30.0% | |
| Total Project Basis for Depreciation: | $255,000 | |
| Total Cash Benefit From Depeciation: | $103,275 | |

| kW Installed | 100 | 2,000 | Final Cost |
|---|---|---|---|
| Ground Mount | $3.00 | $2.55 | $3.00 |
| Roof Mount | $3.10 | $2.65 | $3.10 |
| Parking Canopy | $3.50 | $3.00 | $3.50 |

# Strategies for Success: Financing

| Electric Rate with Escalator | Year | Annual Electricity Generation (kWh) |
|---|---|---|
| $0.0950 | 2013 | 132,000 |
| $0.0960 | 2014 | 131,340 |
| $0.0969 | 2015 | 130,683 |
| $0.0979 | 2016 | 130,030 |
| $0.0989 | 2017 | 129,380 |
| $0.0998 | 2018 | 128,733 |
| $0.1008 | 2019 | 128,089 |
| $0.1019 | 2020 | 127,449 |
| $0.1029 | 2021 | 126,811 |
| $0.1039 | 2022 | 126,177 |
| $0.1049 | 2023 | 125,547 |
| $0.1060 | 2024 | 124,919 |
| $0.1070 | 2025 | 124,294 |
| $0.1081 | 2026 | 123,673 |
| $0.1092 | 2027 | 123,054 |
| $0.1103 | 2028 | 122,439 |
| $0.1114 | 2029 | 121,827 |
| $0.1125 | 2030 | 121,218 |
| $0.1136 | 2031 | 120,612 |
| $0.1148 | 2032 | 120,009 |
| $0.1159 | 2033 | 119,409 |
| $0.1171 | 2034 | 118,812 |
| $0.1182 | 2035 | 118,217 |
| $0.1194 | 2036 | 117,626 |
| $0.1206 | 2037 | 117,038 |
| $0.1218 | 2038 | 116,453 |

| Annual Cash Flow | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| System Revenues | | | | | | | | System Costs | | | | |
| Electricity Revenue | SACP Schedule | SACP % | SRECS Revenues | MEA Clean Energy | MEA Production Tax Credit | Federal ITC Cash Benefit | Federal MACRS Depreciation | O&M, Asset Mgt, Insurance | Inverter Reserve, Soft Costs | Land / Lease Expense | Total Annual Cash Flow |
| $12,540 | $400 | 30.0% | $15,840 | $13,500 | $1,122 | $90,000 | $36,146 | ($2,400) | ($1,200) | $0 | **$165,949** |
| $12,602 | $400 | 30.0% | $15,761 | | $1,116 | | $26,852 | ($2,472) | ($1,200) | $0 | **$53,059** |
| $12,664 | $350 | 30.0% | $13,722 | | $1,111 | | $16,111 | ($2,546) | ($1,200) | $0 | **$40,212** |
| $12,727 | $350 | 30.0% | $13,653 | | $1,105 | | $11,371 | ($2,623) | ($1,200) | $0 | **$35,384** |
| $12,790 | $200 | 30.0% | $7,763 | | $1,100 | | $11,371 | ($2,701) | ($1,200) | $0 | **$29,322** |
| $12,853 | $200 | 30.0% | $7,724 | | | | $1,425 | ($2,782) | ($1,200) | $0 | **$18,221** |
| $12,917 | $150 | 30.0% | $5,764 | | | | | ($2,866) | ($1,200) | $0 | **$14,766** |
| $12,981 | $150 | 30.0% | $5,735 | | | | | ($2,952) | ($1,200) | $0 | **$14,715** |
| $13,045 | $100 | 30.0% | $3,804 | | | | | ($3,040) | ($1,200) | $0 | **$12,710** |
| $13,110 | $100 | 30.0% | $3,785 | | | | | ($3,131) | ($1,200) | $0 | **$12,664** |
| $13,175 | $50 | 30.0% | $1,883 | | | | | ($3,225) | ($1,200) | $0 | **$10,683** |
| $13,240 | $50 | 30.0% | $1,874 | | | | | ($3,322) | ($1,200) | $0 | **$10,642** |
| $13,305 | $50 | 30.0% | $1,864 | | | | | ($3,422) | ($1,200) | $0 | **$10,598** |
| $13,371 | $50 | 30.0% | $1,855 | | | | | ($3,524) | ($1,200) | $0 | **$10,552** |
| $13,438 | $50 | 30.0% | $1,846 | | | | | ($3,630) | ($1,200) | $0 | **$10,503** |
| $13,504 | $50 | 30.0% | $1,837 | | | | | ($3,739) | ($1,200) | $0 | **$10,452** |
| $13,571 | $50 | 30.0% | $1,827 | | | | | ($3,851) | ($1,200) | $0 | **$10,397** |
| $13,638 | $50 | 30.0% | $1,818 | | | | | ($3,967) | ($1,200) | $0 | **$10,340** |
| $13,706 | $50 | 30.0% | $1,809 | | | | | ($4,086) | ($1,200) | $0 | **$10,279** |
| $13,773 | $50 | 30.0% | $1,800 | | | | | ($4,208) | ($1,200) | $0 | **$10,215** |
| $13,842 | $50 | 30.0% | $1,791 | | | | | ($4,335) | ($1,200) | $0 | **$10,148** |
| $13,910 | $50 | 30.0% | $1,782 | | | | | ($4,465) | ($1,200) | $0 | **$10,078** |
| $13,979 | $50 | 30.0% | $1,773 | | | | | ($4,599) | ($1,200) | $0 | **$10,004** |
| $14,048 | $50 | 30.0% | $1,764 | | | | | ($4,737) | ($1,200) | $0 | **$9,926** |
| $14,118 | $50 | 30.0% | $1,756 | | | | | ($4,879) | ($1,200) | $0 | **$9,845** |
| $14,188 | $50 | 30.0% | $1,747 | | | | | ($5,025) | ($1,200) | $0 | **$9,760** |

| Total Investment | $300,000 |
|---|---|

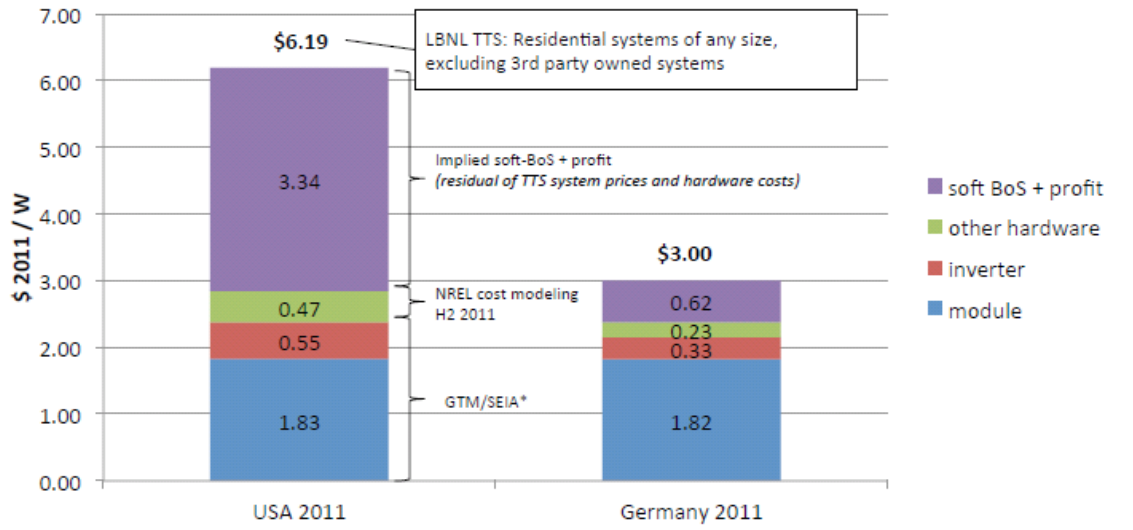
| Federal Tax Paid | State Tax Paid | Total Annual Cash Flow | Cumulative Cash Flow (Post |
|---|---|---|---|
| ($13,791) | ($1,363) | $150,795 | $150,795 |
| ($9,033) | ($1,358) | $42,669 | $193,463 |
| ($8,313) | ($1,245) | $30,654 | $224,118 |
| ($8,282) | ($1,241) | $25,861 | $249,979 |
| ($6,213) | ($916) | $22,193 | $272,172 |
| ($5,808) | ($913) | $11,500 | $283,672 |
| ($5,115) | ($804) | $8,846 | $292,518 |
| ($5,098) | ($801) | $8,816 | $301,334 |
| ($4,413) | ($694) | $7,603 | $308,937 |
| ($4,397) | ($691) | $7,576 | $316,513 |
| ($3,721) | ($585) | $6,377 | $322,890 |
| ($3,707) | ($583) | $6,352 | $329,242 |
| ($3,692) | ($580) | $6,326 | $335,568 |
| ($3,676) | ($578) | $6,299 | $341,867 |
| ($3,659) | ($575) | $6,270 | $348,137 |
| ($3,641) | ($572) | $6,239 | $354,376 |
| ($3,621) | ($569) | $6,207 | $360,583 |
| ($3,601) | ($566) | $6,173 | $366,756 |
| ($3,580) | ($563) | $6,137 | $372,892 |
| ($3,558) | ($559) | $6,099 | $378,991 |
| ($3,534) | ($555) | $6,059 | $385,049 |
| ($3,510) | ($552) | $6,017 | $391,066 |
| ($3,484) | ($547) | $5,973 | $397,039 |
| ($3,457) | ($543) | $5,926 | $402,965 |
| ($3,428) | ($539) | $5,878 | $408,843 |
| ($3,398) | ($534) | $5,827 | $414,671 |

**NOTES:**
Variables are noted with blue text and highlighted
Costs do not include cost of capital.
SREC prices are only estimates.
Model does not include cost for decommissioning at end of life
Federal Tax is paid on Electricity, SREC, State Grants/Incentives, State Tax is paid on Electricity, SREC
***This entire spreadsheet is for educational purposes only. MEA cannot be held responsible for any assumptions, calculations, or estimates.***

# Strategies for Success: Permitting

## Soft Costs for Residential PV in Germany Are ~$2.7/W Lower Than in the U.S.

Total soft costs for residential PV in Germany, including margin, are just 19% of the implied soft costs for U.S. residential PV ($0.62/W vs. $3.34/W)




* **Note:** US module and inverter prices are based on average factory gate prices for Q4 2010-Q3 2011 as reported by GTM/SEIA with an adder of 10% to account for supply chain costs. Inverter efficiency assumed to be 85%.

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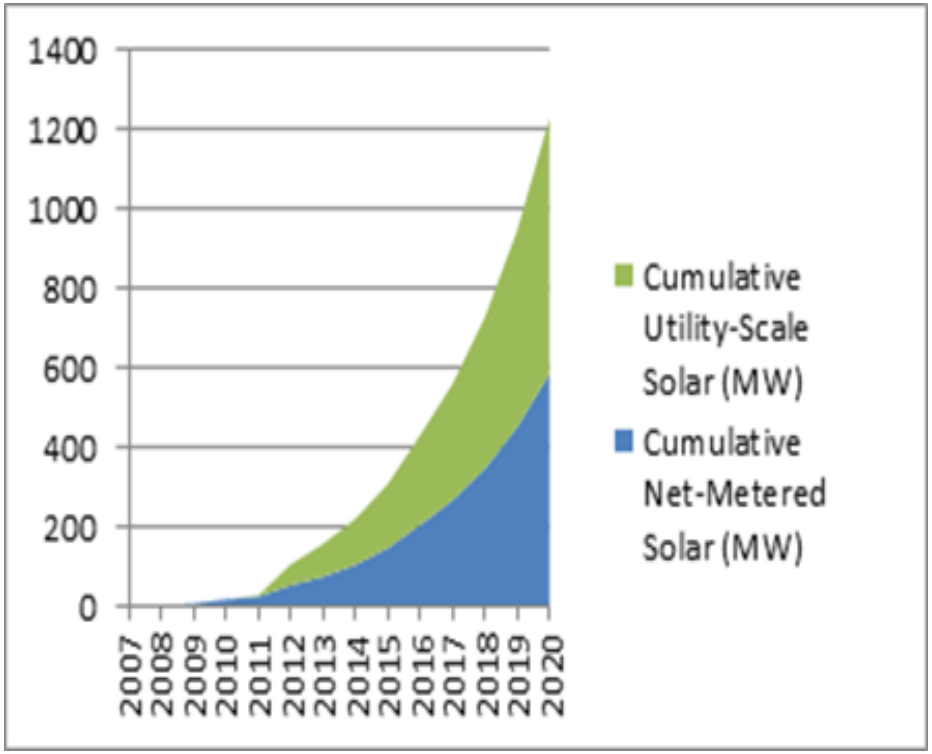
# Strategies for Success: Permitting

For Electrical permits, a Diamond symbol (◆) indicates permits are only needed if new wiring is required.
Talbot County (●) does not require a Plumbing permit for Solar Water Heating, but does require a Zoning Certificate
Baltimore County (■) requires a Building Permit for PV projects over 10 kW

| | Geothermal Heat Pump | | | Solar Photovoltaic | | Solar Water Heating | | |
|---|---|---|---|---|---|---|---|---|
| County | HVAC/Mech. | Electrical | Well | Building | Electrical | Building | Electrical | Plumbing |
| Allegany | ☐ | ☐ | ✓ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Anne Arundel | ✓ | ◆ | ✓ | ✓ | ✓ | ✓ | ◆ | ✓ |
| Baltimore City | ✓ | ◆ | ✓ | ✓ | ✓ | ✓ | ◆ | ✓ |
| Baltimore County | ☐ | ✓ | ✓ | ■ | ✓ | ✓ | ◆ | ✓ |
| Calvert | ☐ | ◆ | ✓ | ✓ | ✓ | ☐ | ☐ | ✓ |
| Caroline | ☐ | ☐ | ✓ | ✓ | ✓ | ☐ | ☐ | ✓ |
| Carroll | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ◆ | ✓ |
| Cecil | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ◆ | ✓ |
| Charles | ✓ | ◆ | ✓ | ✓ | ✓ | ☐ | ☐ | ✓ |
| Dorchester | ✓ | ◆ | ✓ | ✓ | ✓ | ✓ | ☐ | ✓ |
| Frederick | ☐ | ◆ | ✓ | ✓ | ✓ | ✓ | ☐ | ✓ |
| Garrett | ☐ | ☐ | ✓ | ☐ | ✓ | ☐ | ☐ | ☐ |
| Harford | ✓ | ◆ | ✓ | ✓ | ✓ | ☐ | ◆ | ✓ |
| Howard | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ☐ | ✓ |
| Kent | ☐ | ◆ | ✓ | ✓ | ✓ | ☐ | ☐ | ✓ |
| Montgomery | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ◆ | ✓ |
| Prince George's | ✓ | ◆ | ✓ | ✓ | ✓ | ✓ | ◆ | ✓ |
| Queen Anne's | ✓ | ◆ | ✓ | ✓ | ✓ | ☐ | ☐ | ✓ |
| Somerset | ☐ | ◆ | ✓ | ✓ | ✓ | ☐ | ☐ | ✓ |
| St. Mary's | ☐ | ◆ | ✓ | ✓ | ✓ | ☐ | ☐ | ✓ |
| Talbot | ✓ | ◆ | ✓ | ✓ | ✓ | ☐ | ☐ | ● |
| Washington | ✓ | ◆ | ✓ | ✓ | ✓ | ✓ | ☐ | ✓ |
| Wicomico | ☐ | ◆ | ✓ | ✓ | ✓ | ✓ | ☐ | ✓ |
| Worcester | ☐ | ◆ | ✓ | ✓ | ✓ | ✓ | ☐ | ✓ |



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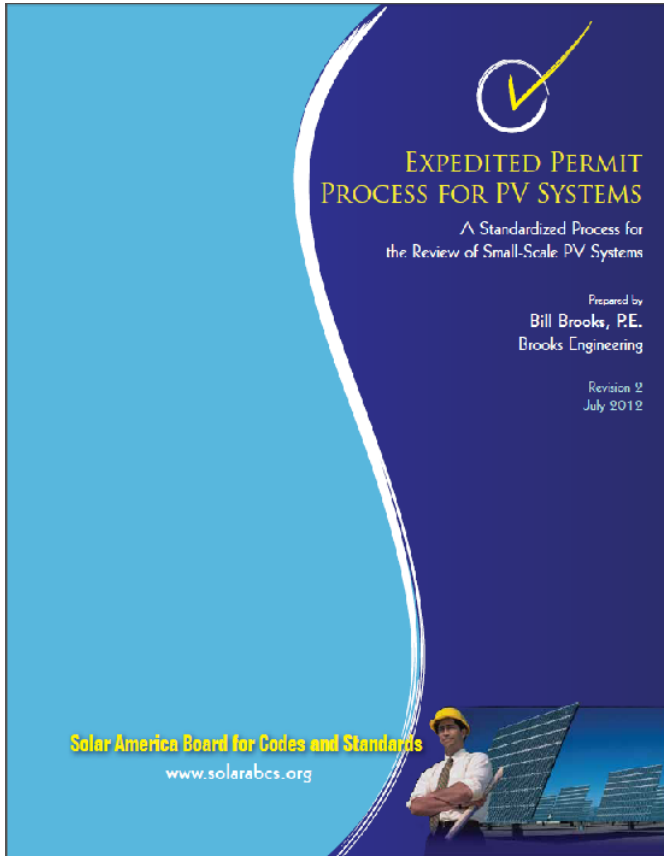


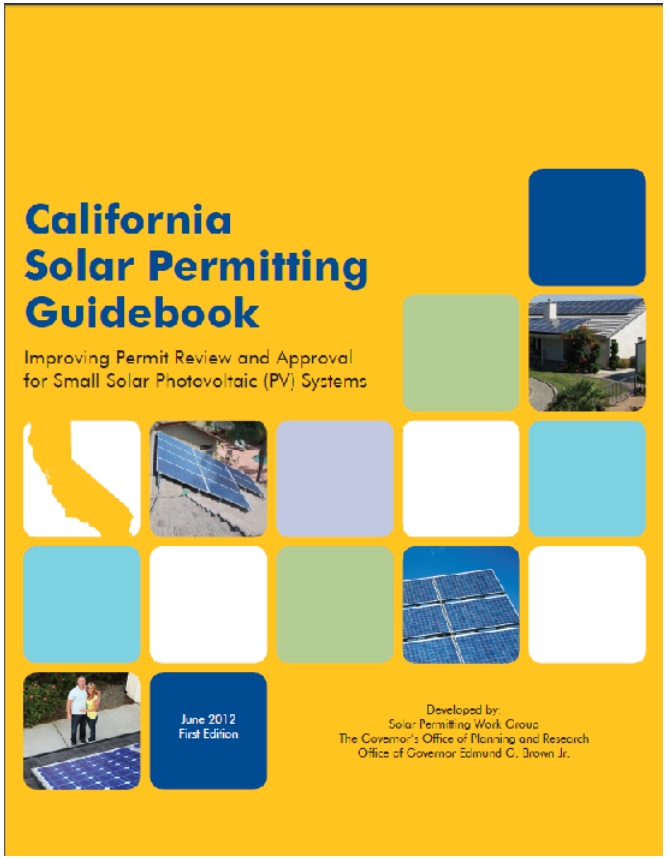

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